Before the
Federal Communications Commission
Washington, D.C. 20554

In the matter of	)
	)
Curtis-Wright Controls Inc. Embedded Computing	)
Petition for Waiver of the Part 15 Ultra-Wideband	)
(UWB) Regulations	)

ORDER

Adopted: January 25, 2007 **Released: January 26, 2007**

By the Chief, Office of Engineering and Technology:

I. INTRODUCTION

1. By this action, we are granting the Petition for Waiver filed by Curtiss-Wright Controls Inc. Embedded Computing ("CWCEC") to permit the certification and subsequent marketing and operation of a limited number of units of its Quick Reaction Perimeter Intrusion Detection ("QUPID") fixed surveillance ultra-wideband ("UWB") imaging system.[1] CWCEC requests a waiver of the average and peak emission limits in rule Sections 15.511(c) and (e) for its QUPID transmitter.[2] We find that a grant of this waiver would allow for the operation of devices that support homeland security by providing protection from terrorist acts and other undesired intrusions to high risk, secured facilities. While we are permitting CWCEC's QUPID transmitter to operate at higher emission levels than allowed by our rules, we are conditioning this waiver on several operational and technical requirements to ensure that harmful interference is not caused to authorized radio services. In particular, we are requiring specific emission limits that, in some cases, are lower than those originally requested by CWCEC. In addition, we are limiting the locations where the QUPID system may be employed; we are limiting the number of facilities per year in which the QUPID equipment may be installed; we are requiring that each QUPID installation have a minimum separation from other radio operations; and we are requiring that the coordination of each QUPID system installation with Federal Government operations be completed and acknowledged by the Commission before operation may commence.

II. BACKGROUND

2. The QUPID UWB surveillance system was designed to augment security and defense systems, providing an advanced warning of potential intruders to sites that have strategic, military or

[1] CWCEC filed its Petition for Waiver on July 18, 2003, and filed an amendment to its Petition for Waiver on October 4, 2004. The original petition was filed under the name Vista Controls, a Curtiss-Wright Company. Vista Controls is now part of CWCEC.

[2] *See* 47 C.F.R. § 15.511. CWCEC's request for a waiver of these specific paragraphs in 47 C.F.R. § 15.511 is contained in its supplement to its reply comments. CWCEC initially requested a waiver of the emission limits specified in 47 C.F.R. § 15.511(d) and (f). These were the paragraphs corresponding to the average and peak emission levels adopted by the Commission in the UWB *First Report and Order*. *See First Report and Order* in ET Docket No. 98-153, 17 FCC Rcd 7435 (2002). However, the rules were changed by the Commission in the subsequent UWB *Memorandum Opinion and Order*. *See Memorandum Opinion and Order and Further Notice of Proposed Rule Making* in ET Docket No. 98-153, 18 FCC Rcd 3857 (2003). The rule sections and paragraphs cited in this Order correspond to their current designations in 47 C.F.R. Part 15.

significant commercial interests, such as public utilities, nuclear power plants, public water supplies, petroleum sites, industrial sites, and national landmarks.[3] This radar system can be used to detect fast moving objects, *e.g.*, vehicles, as well as slow moving, small cross section objects, *e.g.*, persons crawling. The QUPID system currently is being employed by the Air National Guard and by the U.S. Air Force. It operates at a nominal center frequency of 2300 MHz using directional antennas to limit emissions beyond a 90° azimuth and a 15° elevation.[4] QUPID employs a low pulse repetition frequency ("PRF"), nominally 2441 Hz, that is dithered. Individual transmitters are placed at 40 to 80 meters separations with the transmitters directed outward along a perimeter line, enabling the system to detect intrusions towards or into a protected area. The nominal operating range is on the order of 100 meters from the perimeter line.[5] In order for this system to be effective, the protected coverage area must be a prepared area, devoid of trees, brush or any object that can move.[6] Since any movement in the protection zone will trigger an alarm, this protected coverage area must be entirely within the boundary of the secured facility and under the user's direct control or its purpose would be defeated by the recurrence of false alarms from moving objects over which it has no control. CWCEC adds that every installation will have an unprotected "buffer zone" that lies between the protection zone and the physical boundary of the user's property in order to provide a sufficient margin of reliability.

3. The unlicensed operation of a UWB surveillance transmitter is subject to the requirements contained in Subpart F of the Part 15 regulations.[7] The fundamental emission must be contained between 1990 MHz and 10,600 MHz at a root-mean-square ("RMS") average equivalent isotropically radiated power ("EIRP") that does not exceed -41.3 dBm/MHz and at a peak EIRP that does not exceed 0 dBm/50 MHz.[8] Coordination with the Commission is required for each installation.[9] As with all Part 15 devices, operation of unlicensed UWB surveillance is on a sufferance basis whereby the operator must accept any received interference and must not cause harmful interference to the authorized radio services.[10] CWCEC requests a waiver of 47 C.F.R. § 15.511 to permit its QUPID transmitter to operate at at a peak EIRP of 40 dBm/50 MHz and at the following RMS average EIRP emission levels:

Frequency Band in MHz	UWB RMS Limit (dBm/MHz)[11]	Requested Emission Limit (dBm/MHz)[12]	Increase above UWB Limits (dB)
960-1160	-53.3	-45	8.3
1160-1500	-53.3	-47	6.3
1500-1610	-53.3	-52	1.3

[3] A more detailed explanation of desired operating sites is contained in the amendment to CWCEC's Petition for Waiver, *supra*.

[4] CWCEC states that the use of these directional antennas inherently protects receivers located within a customer's facility.

[5] QUPID is designed to provide protection zones of 42, 82 and 112 meters.

[6] CWCEC states that even the grass must be maintained below a certain height to avoid detectable motion from wind.

[7] *See* 47 C.F.R. §§ 15.501 *et seq*.

[8] *See* 47 C.F.R. §§ 15.511 and 15.521(g).

[9] *See* 47 C.F.R. §§ 15.511(b)(2) and 15.525.

[10] *See* 47 C.F.R. § 15.5.

[11] *See* 47 C.F.R. § 15.511.

[12] The emission levels shown in the table are the final levels requested by CWCEC after a series of modifications in its reply comments and in its *ex parte* submissions of September 22, 2006, September 29, 2006, November 2, 2006, and November 22, 2006.

1610-1900	-51.3	-47	4.3
1900-1990	-51.3	-35	16.3
1990-2115	-41.3	-24	17.3
2115-2600	-41.3	-20	21.3
2600-2700	-41.3	-30	11.3
2700-3650	-41.3	-26.3	15
3650-3800	-41.3	-41.3	0
3800-4000	-41.3	-39.3	2
4000-10500	-41.3	-41.3	0
Above 10500	-51.3	-51.3	0

4. The CWCEC petition was placed on notice for public comment.[13] Comments and replies were received from ARINC Incorporated, *et al* (the "Coalition"), AT&T Wireless Services, Inc. ("AT&T"), the Cellular Telecommunications & Internet Association ("CTIA"), IEEE 802.18 Radio Technical Advisory Group ("RR-TAG"), NTIA, the Satellite Industry Association ("SIA"), Verizon Telephone Companies ("Verizon"), and CWCEC. The late-filed comments submitted by the U.S. GPS Industry Council (the "Council") and all *ex parte* contacts also were considered.

III. COMMENTS

5. The Coalition, AT&T, CTIA, RR-Tag, SIA, the Council and Verizon all object to grant of the waiver. Their comments express concern about potential interference to Global Positioning System ("GPS") receivers, the Personal Communications Service ("PCS"), Satellite Digital Audio Radio Services ("SDARS"), unlicensed Part 15 operations, C-band fixed satellite service ("FSS"), fixed broadband services in the 2.3 GHz band, aviation services, future advanced wireless services below 3 GHz, and other radio services.

6. The Coalition and RR-TAG state that CWCEC's waiver fails to satisfy the Commission's waiver standards because CWCEC has not shown that its QUPID system presents any unusual or special factual circumstances. The Coalition adds that CWCEC has not shown why it cannot meet the power and emission limits and that CWCEC proposes no limit on deployment of the QUPID system. The Council supports the Coalition's position and states that the restriction on the types of locations where the QUPID system may be installed, as listed by CWCEC in its amendment to its petition, does not reduce the potential for interference or justify that these transmitters should be permitted to operate under Part 15, believing that there are other regulatory vehicles that could be used to protect the nation's critical infrastructure. The Coalition and RR-TAG, among others, believing that the adequacy of the adopted UWB standards to prevent harmful interference is contentious, state that CWCEC's waiver is "grossly excessive," requesting emission levels far in excess of the UWB limits. The Coalition and RR-TAG argue that the peak power produced by QUPID would be 1 to 4 kW. The Coalition adds that this higher peak limit would result in over 0.4 W of energy being radiated into the GPS bands while RR-TAG states that 100-400 W of energy would be radiated into adjacent bands. The Coalition and RR-TAG believe that these levels will impact GPS, PCS, SDARS and other services. CTIA also argues that CWCEC fails to satisfy the Commission's standards for a waiver by failing to demonstrate that QUPID will not cause harmful interference to existing licensed services, including the PCS, Multichannel Multipoint Distribution Service ("MMDS") and Wireless Communication Service ("WCS"), as well as to future advanced wireless services due to increased out-of-band emissions. CTIA argues that CWCEC must

[13] *See Office of Engineering and Technology Declares CWCEC Controls Request for a Waiver of Part 15 for an Ultra-wideband System to be a "Permit-but-disclose" Proceeding for Ex Parte Purposes*, DA 03-2631, August 11, 2003.

conclusively demonstrate, through actual tests, that QUPID operation will not threaten existing and operational commercial systems in and around CWCEC's proposed operating area. SIA believes that the CWCEC waiver will not serve the public interest, arguing that it will increase the interference potential to C-band FSS operations by a factor of 10,000 times. SIA states that the Commission has already concluded that low PRF devices have a higher potential for causing interference.[14] SIA also states that CWCEC's interference testing is unreliable since it used only a single device instead of a sensor array as is used to provide perimeter security. AT&T argues that the waiver would undermine the purpose of the UWB rules, *i.e.*, to prevent harmful interference to licensed carriers such as fixed services in the 2.3 GHz band. AT&T adds that CWCEC has not addressed the effect of QUPID operation on the unlicensed operations in the 2.4 GHz band and, because there would be a higher potential for interference, has failed to show that a waiver would be in the public interest. Verizon believes that emissions from the QUPID transmitter will cause interference to licensed services beyond the 100 meters coverage area. Verizon states that QUPID will cause interference to its fixed broadband service in the 2.3 GHz band, even at a separation of 100 meters. Verizon also argues that nothing in CWCEC's request would prevent entities from purchasing and using QUPID in areas where licensed services are operating within QUPID's 100 meters coverage area. In its *ex parte* filings,[15] the Council argues that operation of the QUPID system will result in a 1 dB increase in the noise floor for systems operating in the 960-1610 MHz band, *e.g.*, GPS receivers, at a distance of up to 90 meters.[16] In order to ensure protection at such separation distances, the Council requests licensing and coordination of the CWCEC QUPID systems. The Council also requests that the Commission place the following conditions on any waiver provided to CWCEC: 1) limit emissions in the 1160-1500 MHz band to -47 dBm/MHz and emissions in the 1500-1610 MHz band to -52 dBm/MHz; 2) limit the PRF to 2.44 kHz; 3) require QUPID systems to be offset from the perimeter of the property on which they are installed by no less than 108 meters; and 4) limit the QUPID transmitter to the use of pulse position modulation.

7. CWCEC, in its reply comments, argues that it has credibly established that no other FCC-approved wireless perimeter protection and surveillance system has the capability to detect both fast moving vehicles and low crawling intruders which it indicates is an important national security function. Thus, CWCEC concludes that a waiver is in the public interest. CWCEC also notes that the emission levels produced by the QUPID transmitter will never exceed the UWB emission limits at the user's property boundary, negating any obligation to conduct numerous and costly interference studies. Further, CWCEC states that its waiver is narrowly tailored to homeland security applications and that the market for its systems, that of ultra high security installations, is by nature relatively small. Because of these features, CWCEC argues that granting its waiver will not encourage a number of similar requests. In its amendment to its Petition for Waiver, CWCEC states that it seeks to install the QUPID equipment for protecting the nation's critical infrastructure in areas of transportation, energy, vital human services, information and communications, weapons manufacturing and storage facilities, and prisons and detention facilities provided those locations have available combined protection and buffer zones of at least 108 meters. With regard to the Council's *ex parte* comments, CWCEC notes that the emission levels that will be produced at the property boundary would be lower than the emissions levels required from any other nearby Part 15 device and that, at the PRF employed, the QUPID system is virtually incapable of causing interference to GPS systems. CWCEC does, however, amend the emission mask for

[14] SIA cites the *Memorandum Opinion and Order and Further Notice of Proposed Rule Making* ("*MO&O and FNPRM*") in ET Docket No. 98-153, 18 FCC Rcd 3857 (2003) at para. 154.

[15] *Ex parte* filings were made by the Council on October 19, 2006, on November 13, 2006, and on December 18, 2006.

[16] The Council bases its claim on the emission levels proposed for the 960-1610 MHz band in CWCEC's supplemental filing of September 29, 2006. Those levels were superseded by CWCEC's filing of November 2, 2006.

its requested waiver.[17] CWCEC states that: 1) its proposed emission mask already meets the emission limits requested by the Council in the 1160-1610 MHz band; 2) while the approximate PRF of the QUPID system is 2.44 kHz this should not be made a condition of the waiver since, as stated by the Commission in the UWB *First Report and Order*,[18] operation at any PRF below 100 kHz poses no interference threat to GPS; 3) that the required level of set-back from the property boundary should be no greater than 34 meters in light of CWCEC's reduction in the fundamental emission level; and 4) that it is not clear what the purpose would be for the Council's condition to limit the QUPID transmitter to pulse position modulation.

IV. DISCUSSION

8. It is a well established principle that the Commission will waive its rules if it determines, after careful consideration, that such a grant would serve the public interest without undermining the policy which the rule in question is intended to serve.[19] We find that a waiver of the emission limits in 47 C.F.R. §§ 15.511 and 15.521(g) is consistent with that principle.[20]

9. The CWCEC QUPID UWB surveillance system will enhance the protection of installations that are vital to the public well-being, facilitating homeland security efforts. In view of these benefits, we find that the ability to use this equipment is in the public interest. We concur with CWCEC that its QUPID UWB surveillance system provides unique intrusion detection capabilities that may not otherwise be available under other Commission regulations.[21] We also concur with CWCEC that emission levels higher than those permitted under the unlicensed UWB regulations are necessary in order for this surveillance and security system to have sufficient range when detecting targets with small radar cross sections.[22] Finally, we find that the implementation of certain operational restrictions should ensure that harmful interference does not occur. We conclude that CWCEC's request for waiver does not undermine the policy of Sections 15.511 and 15.521 and that a waiver of the regulations is in the public interest. Accordingly, we are granting CWCEC a waiver of the emission limits in Sections 15.511 and 15.521(g), subject to certain conditions enumerated below.

10. *Emission limits*. The objections filed in response to CWCEC's Petition for Waiver are based on the contention that UWB operations, including the QUPID transmitter, will cause harmful interference to the licensed services. However, these objections are not supported by factual evidence. Instead, these concerns expressed in the opposing comments are based, incorrectly, on an underlying assertion that the existing emission limits for UWB devices are not sufficient, despite several previous Commission decisions and, in the case of GPS, NTIA analyses concluding otherwise.[23] AT&T also raises the possibility of interference to 2.4 GHz unlicensed operations. However, unlicensed systems are required to operate on a sufferance basis where the operator must accept any interference that is received,

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17 The amended mask is the final mask shown earlier in this Order.

18 *1st Report and Order* in ET Docket No. 98-153, *Supra*.

19 *See WAIT Radio v. FCC*, 418 F.2d 1153 (D.C. Cir. 1969).

20 While CWCEC only requests a waiver of 47 C.F.R. § 15.511(c) and (e), the peak emission limit contained in 47 C.F.R. § 15.511(e) is replicated in 47 C.F.R. § 15.521(g). A waiver of both rule sections is necessary.

21 We are unaware of other system designs that are capable of performing the types of operation described by CWCEC for its QUPID system, and no party has brought any to our attention.

22 As the target cross section decreases in size, so does the level of the reflected radar signal. Thus, smaller cross section targets require increased power for detection by the radar system.

23 While Verizon, for example, states that an analysis conducted by the manufacturer of its fixed wireless broadband equipment indicates that harmful interference could occur, it did not submit such analysis in this proceeding.

regardless of the source of that interference.[24] Two of the comments erroneously argue that the small, generally battery-operated UWB surveillance devices will emit thousands of watts of energy and, thus, will produce significant signal levels into adjacent frequency bands.[25] We also note that the opposing comments generally are based on the higher emission levels originally proposed by CWCEC. These original emission levels were reduced significantly based on further testing by CWCEC of the QUPID system and through coordination by CWCEC with NTIA.

11. The Commission staff, in coordination with NTIA, measured the emission levels produced by a QUPID transmitter. These measurements were performed over specific frequency bands to determine the levels associated with both the fundamental (-10 dB) bandwidth and the unwanted emissions. The following results were obtained:

Frequency Band (MHz)	Primary Radio Service Allocation[26]	Representative Radio System	UWB RMS Limit (dBm/MHz EIRP)	Maximum Measured RMS Level (dBm/MHz EIRP)[27]	Increase above UWB Limits (dB)
1164-1189	ARNS/RNSS	GPS L5	-53.3[28]	-47.3	6
1215-1240	RNSS/RL	GPS L2/L-band radar	-53.3	-48.8	4.5
1563-1588	ARNS/RNSS	GPS L1	-53.5	-52.9	0.6
1710-1755	Fixed/Mobile	3G Band 1	-51.3	-44.3	7
1850-1910	Fixed/Mobile	PCS Handsets	-51.3	-49.0	2.3
1930-1990	Fixed/Mobile	PCS Base Stations	-51.3	-43.5	7.8
2110-2155	Fixed/Mobile	3G Band 2	-41.3	-28.5	12.8
2320-2345	Broadcast Satellite	SDARS	-41.3	-22.1	19.2
2700-2900	ARNS/Met Aids/RL	S-band Radar (ASR/WWR)	-41.3	-30.1	11.2
2900-3100	MRNS/RL	Maritime Radar	-41.3	-26.6	14.7
3650-4200	Fixed/Fixed Satellite	C-Band Earth Station	-41.3	-40.8	0.5

The emissions consist of a time-dithered train of pulses with a nominal pulse period ("T") of 410 microseconds resulting in a PRF of 2440 Hz. The width of an individual pulse is approximately 5 nanoseconds, and the nominal peak-to-average ratio is 30 dB. The highest RMS EIRP emission level, -20.3 dBm/MHz, was obtained at 2325 MHz.[29] The highest peak emission level, 7.6 dBm/MHz, also was

[24] *See* 47 C.F.R. § 15.5.

[25] CWCEC, in its reply comments, provides an explanation as to why these claims of high power spurious emission levels are incorrect. Regardless, the total power is not significant in determining potential interference. It is the power produced within the bandwidth of a victim receiver that determines interference potential.

[26] ARNS = Aeronautical Radio Navigation Service; RNSS = Radio Navigation-Satellite Service; RL = Radiolocation Service; Met Aids = Meteorological Aids Service; MRNS = Maritime Radio Navigation Service; SDARS = Satellite Digital Audio Radio Service.

[27] These are the maximum levels measured in each of the specified frequency bands. There is some variation in the emission levels across the each measured band.

[28] UWB devices also are required to comply with a -63.3 dBm RMS EIRP limit in the L1, L2 and L5 GPS frequency bands of 1559-1610 MHz, 1215-1240 MHz, and 1164-1189 MHz, respectively, when measured with a resolution bandwidth of no less than 1 kHz. The emissions from the QUPID transmitter were attenuated below the existing limit by 13.9 to 19.7 dB.

[29] This emission level was obtained based on a full spectrum scan without the use of a low noise amplifier ("LNA"). A limited span measurement using an LNA and a tunable bandpass filter produced a maximum RMS (continued....)

measured at 2325 MHz, an increase of 41.6 dB over the current UWB limit.[30] The -10 dB measured operating bandwidth is 2133-3093 MHz with a center frequency of 2613 MHz and a -10 dB bandwidth of 960 megahertz. Contrary to the claims of the commenters, no 1-4 kW fundamental emissions, no 0.4 W emissions in the GPS bands, and no 100-400 W spurious emissions were detected.

12. Based on the measurements by our laboratory and on the latest emission mask submitted by CWCEC, we conclude that it is not necessary to provide an emission level for the QUPID transmitter of -10 dBm/MHz across the entire 1990-10600 MHz band, as sought by CWCEC in its original petition and reply comments. Rather, it appears that the -10 dB fundamental emission may be confined to the 1990-3650 MHz band and that the limits on emissions across the 960-10600 MHz frequency range may be decreased to provide additional interference protection to the authorized radio services, as noted by CWCEC in its further supplemental filing. As with existing UWB surveillance system transmitters, we are requiring that radiated emissions at or below 960 MHz shall not exceed the emission levels in 47 C.F.R. § 15.209. For all other frequencies, we will require that the RMS average EIRP, as determined using a 1 MHz resolution bandwidth, not exceed the following:

Frequency in MHz	EIRP in dBm
960-1160	-45
1160-1500	-47
1500-1610	-52
1610-1710	-47
1710-1755	-44
1755-1900	-47
1900-1990	-35
1990-2115	-24
2115-2600	-20
2600-2700	-30
2700-3650	-26.3
3650-4000	-40
4000-10600	-41.3
Above 10600	-51.3

We recognize that the emission limits we are adopting are slightly higher in the 1710-1755 MHz and 3650-3800 MHz bands than those requested by CWCEC in its further supplement to its waiver request.[31] The levels stipulated in these bands correspond to our measured data to ensure CWCEC's ability to

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average EIRP signal level of -22.1 dBm which is the value shown in the table. The differences are within the typical uncertainty range associated with radiated RF measurements.

[30] While the UWB emission limit is 0 dBm/50 MHz, per 47 C.F.R. § 15.511(e), 47 C.F.R. § 15.521(g) permits peak measurements to be performed using a lower resolution bandwidth provided there is a corresponding reduction in the peak limit. With a resolution bandwidth of 1 MHz, the current UWB peak emission limit is -34 dBm.

[31] In its November 22, 2006, *ex parte* filing, CWCEC recognized that its emissions may exceed the limit requested in its further supplement to its waiver request for the 3800-4000 MHz band. The Commission's measurements determined that the higher emission level occurred closer to 3700 MHz. In addition, while CWCEC requested that the limit be increased to -39.3 dBm, the Commission's measurements determined that the maximum emission level produced in the 3650-4000 MHz band did not exceed -40.8 dBm. Accordingly, we are requiring an emission limit of -40 dBm in the 3650-4000 MHz band.

comply with the waiver limits.[32] We note that these values remain lower than the levels requested by CWCEC in its original Petition for Waiver and in the amendment to the petition contained in CWCEC's reply comments, on which comments were obtained.[33] As discussed below, these emission limits, in combination with the operating constraints we are placing on the QUPID transmitters, will ensure that harmful interference to the authorized radio services will not occur.

13. In addition to the above emission mask, the narrowband emissions within the GPS bands must continue to comply with the existing limits in 47 C.F.R. § 15.511(d). Further, we will require that the peak EIRP appearing within the 50 MHz band centered on the frequency at which the highest emission occurs not exceed 40 dBm/50 MHz, an increase of 40 dB over the existing limits. As with other UWB surveillance devices, measurements may be made using a lower resolution bandwidth ("RBW" in megahertz) provided the peak power is similarly decreased based on a 20 log (RBW/50) dB ratio.[34]

14. We note that the emission levels produced by CWCEC's QUPID transmitter are lower than the limits for spurious emissions produced by transmitters in most of the authorized radio services, many of which are required to reduce their emissions to a level of 43 + 10 log (power) dB, equivalent to -13 dBm.[35] However, this is not the EIRP level but is the limit on the emission conducted to the transmit antenna. If the antenna provides gain at the frequency of the emission, the resultant EIRP will be higher than the conducted level. The QUPID emission levels also are considerably less than those produced by consumer devices operating in the nearby 2400-2483.5 MHz band.[36] Even so, we are reluctant to grant CWCEC's requested increase in the permitted emission levels for its QUPID transmitter absent some additional assurance that harmful interference will not be caused to the authorized radio services. For that reason, we are requiring that the height above ground for the QUPID antennas be no greater than 10 meters. We also are requiring that every QUPID transmitter, in the direction of its antenna, be located at

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[32] While measurement variations of a few decibels is normal, due to the margin of error in the measurement equipment, the Commission will not grant an application for certification if the submitted data shows that the emission limits are exceeded.

[33] In the 1710-1755 MHz band, CWCEC requested a limit of -25 dBm in its reply comments, a limit of -41.3 dBm in its supplemental filings of September 22, 2006, and September 29, 2006, and a limit of -47 dBm in its further supplemental filing of November 2, 2006. In the 3650-4200 MHz band, CWCEC requested a limit of -10 dBm in its petition and in its reply comments and a limit of -41.3 dBm in its supplemental filings.

[34] RBW may be between 1 MHz and 50 MHz. Because the PRF employed with the QUPID transmitter will be less than RBW, the application of a 20 log ratio, instead of 10 log of the ratio, is proper. *See* NTIA Report 01-383, *The Temporal and Special Characteristics of Ultrawideband Signals*, January 2001, at figure 8.86 on pg. 8-46 through 8-48. This report states that the peak relationship follows a 20 log ratio when the RBW is much greater than the PRF and that dithered peak emissions follow a 10 log ratio only when the RBW is much less than the PRF. In *Assessment of Compatibility between Ultrawideband Devices and Selected Federal Systems*, NTIA Special Publication 01-43, January 2001, at pg. D-1 and D-2, NTIA employed a 10 log ratio to represent the peak power in a 50 MHz bandwidth when the RBW is less than or equal to 2.0 PRF for a dithered emission. The QUPID transmitter operates at a PRF of 2441 Hz so RBW employed for peak measurements always will be greater than 2 PRF.

[35] *See*, for example, 47 C.F.R. §§ 101.111. ITFS and MMDS transmitters are required to attenuate their emissions by only 40 dB or to 33 + 10 log (P) dB, whichever is the lesser attenuation, at 250 kHz from the channel edge (*i.e.*, the emissions conducted to the antenna must be attenuated to -3 dBm or higher) and to 60 dB or 43 + 10 log (P) dB, whichever is the lesser attenuation, at 3 MHz and beyond from the channel edge. *See*, for example, 47 C.F.R. § 74.936(f).

[36] Emissions from such consumer devices that appear outside of the 2400-2483.5 MHz band can range from as high as -14 dBW to as low as -41.3 dBm EIRP, depending on the frequency band. *See* 47 C.F.R. §§ 15.205 and 15.247(d).

least 110 meters from any area accessible to the public (minimum separation zone).[37] Absent some experience with these devices, we are not implementing, at this time, the shorter 34 meters separation zone requested by CWCEC in its *ex parte* filing. We recognize that the 110 meters separation distance should exceed the separation distances necessary to prevent harmful interference to GPS, PCS, SDARS, 3G advanced communication systems, C-band FSS receivers, and future advanced wireless services such as 3G.[38] The separation zone, combined with the limit on the maximum antenna height, also should prevent interference from the QUPID transmitter to other radio operations. This 110 meters separation zone shall not encompass areas that are used by, or accessible to, the public.[39] In addition, the QUPID transmitters and their associated separation zones shall be wholly contained within the boundaries of the property on which the QUPID system is installed.[40] We do not believe that the separation zone requirement will present an installation problem for the QUPID equipment based, in part, on CWCEC's statement in its amendment to its waiver request that it will only install the QUPID systems in locations that have available combined protection and buffer zones of at least 108 meters. As acknowledged by CWCEC, establishing a QUPID operating system in an area that does not contain a sufficiently large separation zone, *e.g.*, in a location that contains a publicly accessible area, will render the QUPID system ineffective due to the number of false alarms. Thus, the QUPID equipment can function effectively only if it has been specifically engineered to a compatible location.

15. While the Coalition and RR-TAG cite several reports to demonstrate that UWB devices cause harmful interference to GPS receivers and the Council argues that the increased emission levels also will result in harmful interference to GPS receivers, they neglect that these earlier reports found that GPS receivers are more robust when the undesired emission occurs at low PRFs, such as those employed by the QUPID system. Furthermore, interference should not occur, regardless of the PRF, at the separation distance of the QUPID transmitters from the public due to the 110 meters separation zone.[41] SIA's argument that the Commission already has concluded that low PRF devices, such as QUPID, have a higher potential for causing interference is taken out of context. The Commission indicated that an interference study produced by NTIA determined that low PRF transmitters can have a higher

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[37] The distance of the separation zone shall be measured from the antenna in every direction in which the QUPID system is intended to detect a target. We note that this separation distance also satisfies the separation distance requested by the Council.

[38] This conclusion is based on previous Commission evaluation and conclusions regarding potential harmful interference from UWB operations. *See*, *e.g.*, *First Report and Order* ("*1st R&O*") in ET Docket No. 98-153, 17 FCC Rcd 7435 (2002). While AT&T raised the possibility of interference to 2.4 GHz unlicensed operations, unlicensed systems operate on a sufferance basis where the operator is required to accept any interference that is received, regardless of the source of that interference, and must resolve any harmful interference caused to an authorized radio service. *See* 47 C.F.R. § 15.5. While we do not believe that interference will occur to 2.4 GHz unlicensed operations, there is no requirement to protect such operations from interference.

[39] We recognize that the QUPID operator may have occasional needs for its security and other personnel to access the separation zones; this access would not be deemed "public access" for purposes of this waiver.

[40] Areas outside of the 110 meters separation zone may be accessible to the general public even if they are within the property boundary.

[41] *See*, for example, *1st R&O*, *supra*, at para. 78-80. NTIA demonstrated that GPS receiver performance was robust when the interfering signal operated at a PRF of 100 kHz or less. Thus, based on the PRF and emission level employed by the QUPID system operating under this waiver, interference should not occur to GPS reception regardless of the separation distance. Further, there is no justification for the Council's request to limit the QUPID system only to the use of pulse position modulation. The only justification for the Council's request to limit PRF and modulation type would be to ensure that this waiver is limited to a specific QUPID system. We agree and are limiting the waiver to CWCEC's specific QUPID device. Subsequent changes to emission characteristics will require a separate waiver request and *de novo* consideration.

interference potential.[42] However, the Commission also noted that this study was based on interference from the UWB peak emission level and did not take into account the Commission's limit on peak emissions.[43] Further, the Commission found that the use of a lower PRF results in a decrease in the levels of the individual spectral lines for a given power level. The Commission also concluded that in cases where the PRF is much less than the receiver's bandwidth, such as occurs with QUPID and C-band FSS receivers, the UWB signal may appear to the receiver as impulsive noise and the effect is proportional to the peak power of the UWB signal unless some type of signal processing is incorporated in the victim receiver.[44] Such processing is used in a multitude of receivers, including GPS and C-band FSS, which would result in these receivers responding to the average emission levels produced by QUPID and not to the higher peak levels, assuming, of course, that the UWB peak level is not high enough to saturate the front end of the victim receiver.

16. We see no need to evaluate interference potential based on the use of multiple QUPID emitters, as requested by SIA. The Commission has previously determined that any potential for harmful interference would be due to emissions from one or two UWB devices and that there is no threat of cumulative harmful interference.[45] In addition, the QUPID emitters employ directional antennas further reducing the probability that signals from multiple QUPID emitters would be directed towards a victim receiver. We also disagree with Verizon that licensed services will operate within the QUPID coverage area or that we should address potential interference within the required separation zone. As stated previously, we are requiring each QUPID emitter to be separated by at least 110 meters from areas used by, or accessible to, the public.

17. We also do not agree that harmful interference will result to the licensed fixed radio services and radar systems operating in the same bands as QUPID. The Commission previously evaluated this interference potential in its UWB proceeding.[46] Unlike conventional UWB devices, the QUPID transmitters employ antennas that are directional not only in the azimuth but also in elevation. We are limiting the height of the QUPID antennas to no greater than 10 meters above ground. CWCEC states that the maximum coverage range of the QUPID system is 112 meters. The use of an antenna height of 10 meters in combination with the antenna being directed downward, as an example, by 15 degrees, enables the QUPID system to provide coverage to a distance of about 115 meters, providing the maximum range cited by CWCEC. The use of such a downward-directed antenna would reduce the potential for the QUPID system to receive interference from, or to cause interference to, other radio service operations. Thus, we believe that it would be to CWCEC's advantage to employ such downward directed antennas. The use of a downward-directed antenna also should facilitate the coordination requirement that we are implementing, as discussed below, with Federal Government operations. Consequently, it is highly unlikely that the QUPID antennas would be aligned with the antennas used by the fixed services or by the licensed radar systems and similarly unlikely that harmful interference would occur. It also is extremely unlikely that any fixed receiver sites or radar systems will be located within the 110 meters separation zone from the QUPID transmitters. Fixed receiver sites and radar systems would be located further away from the QUPID equipment and generally would be located at elevated areas that would improve their coverage while providing some isolation from other radio frequency ("RF") sources. This increased separation distance combined with the directional antenna parameters of

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42 NTIA Special Publication 01-43, *supra*.

43 *See MO&O and FNPRM* in ET Docket No. 98-153, *supra*, at para. 154.

44 *See Second Report and Order and Second Memorandum Opinion and Order* ("*2nd R&O and 2nd MO&O*") in ET Docket No. 98-153, FCC Rcd 24558 (2004), at para. 14

45 *See*, for example, *1st R&O*, *supra*, at para. 226-234, *MO&O and FNPRM*, *supra*, at para. 88, *2nd R&O and 2nd MO&O*, *supra*, at para. 99.

46 *See*, for example, *1st R&O*, *supra*, at para. 164-167 and the *MO&O and FNPRM*, *supra*, at para. 139-142.

the QUPID system should ensure that no harmful interference occurs.

18. Based on the above, we find no evidence that operation of the QUPID system will result in harmful interference to other radio operations. However, in addition to requiring that the QUPID installation maintain a minimum 110 meters separation zone, we are implementing coordination requirements with Federal Government operations and operational restrictions, as discussed below, to further ensure that interference does not occur. We remind CWCEC that it is ultimately responsible for ensuring that the equipment is properly installed and meets all of the conditions of this waiver. CWCEC has an obligation to prevent the operation of this equipment from causing harmful interference to the operation of any radio service. We expect CWCEC to be cognizant of the surroundings in each installation and to take whatever steps are necessary to reduce interference potential, *e.g.*, employing antennas that are tilted downwards whenever feasible and taking advantage of terrain obstructions to minimize signal levels propagating beyond the installed property boundaries. Should the operation of a QUPID installation result in harmful interference, we fully intend to halt further operation of that system until such time that the harmful interference can be resolved, as required under the Part 15 rules.

19. *FCC/NTIA Coordination*. NTIA's regulations, which apply to the operation of RF devices by Federal agencies, permit Federal agencies to use off-the-shelf devices without licensing provided those devices are certified by the Commission to comply with its Part 15 standards.[47] In addition, Federal agencies may operate radio equipment without a license provided the equipment complies with NTIA's standards for unlicensed operation.[48] Subsequent to CWCEC's filing of its Petition for Waiver, NTIA amended its regulations to permit agencies of the Federal Government to operate fixed UWB transmitters that exceed the Commission's limits, provided those agencies have successfully coordinated each installation and obtained authorization through NTIA.[49] The Commission takes part in that coordination process to ensure that harmful interference is not caused to non-Government radio operations. If a Federal Government agency wishes to install a higher power fixed UWB transmitter, it is required to follow the methods contained in NTIA Special Publication 01-43[50] to determine the separation distance that is needed between the UWB device and Federal authorized radio services.[51] These calculated separation distances are termed "coordination trigger distances." If the proposed location of the fixed UWB transmitter falls outside the calculated coordination trigger distances, NTIA will support the request of the agency to use the UWB transmitter. If the location of the UWB device is within the coordination trigger distances, the agency requesting to use the equipment must work with the affected Federal agency or agencies to perform measurements or to develop more detailed analyses to demonstrate that the proposed UWB system is compatible with the authorized services.[52] Once compatibility can be established, NTIA will approve the UWB operation. The agency using the higher powered UWB equipment must submit the system for registration in NTIA's Government Master File ("GMF"). The analyses or measurements used to demonstrate compatibility will become a resource

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47 *See Manual of Regulations and Procedures for Federal Radio Frequency Management*, U.S. Department of Commerce, National Telecommunications and Information Administration, May 2003 Edition, January 2006 Revision, ("NTIA regulations") at Section 7.8.

48 *See* NTIA regulations at Section 7.9. NTIA's specifications for unlicensed operation are similar to the Commission's Part 15 standards.

49 *See* NTIA regulations at Sections 8.3.29, 9.2.5, and 10.3.8.

50 *See* NTIA Special Publication 01-43, *supra*.

51 The NTIA regulations contain provisions to permit the fixed operation of UWB devices that do not comply with NTIA's or the Commission's standards. *See* NTIA regulations at Sections 8.3.29, 9.2.5, and 10.3.8.

52 Changes in the location of the authorized service transmission systems will trigger the need for new analyses or measurements to ensure that the UWB operations continue to be compatible with other radio spectrum operations.

for new coordination trigger distances that may be employed by any other prospective UWB equipment users. NTIA's regulations also state that NTIA will consider similar requests for non-Federal operations that are received from the Commission through NTIA's Interdepartment Radio Advisory Committee ("IRAC") Frequency Assignment Subcommittee ("FAS").[53]

20. The Commission's regulations already contain a requirement that UWB imaging systems, including surveillance systems, must be coordinated with the Commission before operation may begin.[54] While operation of a UWB imaging system complying with the regulations normally may commence upon the filing of the coordination report with the Commission, there are provisions to prohibit operation when additional coordination is required. For the purpose of this waiver, we are establishing an additional coordination procedure similar to that required by NTIA for Federal agencies.[55] The coordinates for all QUPID installations operating under the provisions of this waiver must be provided through the Commission to the NTIA FAS. The locations of the QUPID installations will be compared to the coordination trigger distances established for the Federal systems and radio astronomy facilities identified by NTIA.[56] If the location of the QUPID installation is not within the coordination trigger distance established for each Federal system and radio astronomy facility, the installation will be approved. If the location of the QUPID installation is within the coordination trigger distance, a more detailed technical analysis must be submitted to the Commission. This detailed analysis may consider terrain, antenna directionality, measured signal levels and other particulars unique to each installation site. Measurements assessing compatibility with the Federal systems may also be performed. The completed analysis or measurements will be reviewed by the Commission and coordinated by the Commission with NTIA's FAS. Coordination must be completed and an acknowledgement must be received from the Commission as a prerequisite to the operation of any QUPID system under this waiver. As this coordination does not address a routine UWB operation, the requirement in 47 C.F.R. § 15.525(f) to complete coordination within 15 business days shall not apply. Subsequent to the completion of the coordination process, it is possible that new or expanded Federal Government systems may be located near the QUIPD system. If those new or modified Federal Government systems fall within the coordination trigger distances previously calculated, appropriate changes to the QUPID installation site, *e.g.*, changes to the directional angles of the antennas or the addition of shielding, must be implemented or a more detailed analysis or measurements must be performed to ensure interference compatibility. Unless these changes are implemented, a new analysis is performed, and a new coordination with the Commission and NTIA's FAS is completed prior to the operation of the new or expanded Federal Government systems, operation of the QUPID system shall cease.

21. *Limits on Installation Sites*. CWCEC indicates that it wishes to place QUPID systems in areas involving transportation, energy, vital human services, information and communications, weapons manufacturing and storage facilities, and prisons and detention facilities. However, we are reluctant to open marketing of the QUPID equipment to such widespread applications at this time. We believe a more cautious approach that allows us to confirm that the waiver conditions applied herein are effective is appropriate before we permit widespread use. For that reason, we are limiting the installation of QUPID systems to use only in the following high risk, secured facilities that have controlled access: nuclear

[53] *See* NTIA regulations at Section 9.2.5.

[54] *See* 47 C.F.R. §§ 15.511(b)(2) and 15.525.

[55] We believe that this requirement addresses the arguments presented by the Council to provide licensing and coordination for QUPID transmission systems. While a specific station license is not being issued, and the Council did not indicate how such licensing would be possible since the QUPID transmission system does not fit the standards or allocations within any of the Commission's authorized radio services, the level of coordination is greater than that required for many licensed stations.

[56] The NTIA contact for obtaining this information is Spectrum Engineering and Analysis Division 202-482-2608.

power plants, correctional institutions, public water supply facilities, and public utilities. In addition, we are limiting the marketing of QUPID systems under this waiver to no more than 10 installations per year. Once systems have been installed and this method of preventing harmful interference proves to be practical and is confirmed as effective, we can consider increases in the number and type of permitted installations.

V. SUMMARY OF WAIVER CONDITIONS

22. Based on the above, we are granting the waiver of the emission limits in Sections 15.511(c) and (e) and 15.521(g) for CWCEC's QUPID UWB surveillance imaging system subject to the following conditions.[57] It shall be the responsibility of CWCEC to ensure that all of these provisions are met, including those provisions pertaining to operation by the user.

- The -10 dB bandwidth of the QUPID transmitter shall be contained in the 1990-3650 MHz band and shall comply with all applicable rules in Part 15, including the requirement in Section 15.201 to obtain a grant of certification, except for the standards in Section 15.511 (c) and (e) and in Section 15.521(g). In lieu of these standards, QUPID transmitters shall comply with the following emission levels:
    - The radiated emissions at or below 960 MHz from a device operating under the provisions of this section shall not exceed the emission levels in Section 15.209. The radiated emissions above 960 MHz from a device operating under the provisions of this section shall not exceed the following average limits when measured using a resolution bandwidth of 1 MHz:

Frequency in MHz	EIRP in dBm
960-1160	-45
1160-1500	-47
1500-1610	-52
1610-1710	-47
1710-1755	-44
1755-1900	-47
1900-1990	-35
1990-2115	-24
2115-2600	-20
2600-2700	-30
2700-3650	-26.3
3650-4000	-40
4000-10600	-41.3
Above 10600	-51.3

    - The peak EIRP appearing within the 50 MHz frequency band centered on the frequency at which the highest radiated emission occurs shall not exceed 40 dBm. A resolution bandwidth lower than 50 MHz, but no less than 1 MHz, may be used to determine the peak level provided the measured peak EIRP does not exceed [40 + 20 log (RBW/50)] dBm where RBW is the resolution bandwidth of the measurement instrument in megahertz. Consistent with the current UWB regulations, if an RBW of greater than 3 MHz is employed the application for certification filed with the Commission must contain a detailed description of the test procedure, calibration of the test setup, and the instrumentation employed in the testing.

[57] Other applicable emission limits, *e.g.*, 47 C.F.R. § 15.511(d), continue to apply to the QUPID transmitter.

- The QUPID system shall be used at a fixed location. Each QUPID transmitter shall be located such that there is a separation zone of at least 110 meters, as measured from the antenna in every direction in which the QUPID system is intended to detect a target. This 110 meters separation zone shall not encompass areas that are used by, or accessible to, the public. In addition, the QUPID systems and their associated separation zones shall be wholly contained with the boundary of the property on which the QUPID system is installed.

- The height of the QUPID antenna shall not exceed 10 meters above ground.

- The QUPID systems shall be marketed directly by CWCEC only to, and used only by, the following high risk, secured facilities that have controlled access: nuclear power plants, correctional institutions, public water supply facilities, and public utilities.

- QUPID systems may be installed in no more than 10 facilities in any calendar year.

- The coordination of each QUPID installation with Federal Government operations and radio astronomy facilities, as required under 47 C.F.R. §§ 15.511(b)(2) and 15.525, must be completed and an acknowledgement must be received from the Commission before operation may begin. CWCEC must demonstrate that the location of the QUPID system is beyond the coordination trigger distances established by NTIA for Federal systems and for radio astronomy facilities. If the location of the QUPID system is within the coordination trigger distances established by NTIA, CWCEC will be required to work through the Commission to perform a more detailed analysis or measurements to demonstrate compatibility. This detailed analysis may consider terrain, antenna directionality, measured signal levels and other particulars unique to each installation site. Data previously submitted to the Commission or to NTIA may be used for this purpose. No interference analysis or coordination is required for GPS or FSS receivers or on frequencies where the QUPID transmitter emissions comply with the limits in Section 15.511(c). A request to register the equipment along with supporting information shall be filed at the following address:

  Spectrum Coordination Branch, OET
  Federal Communications Commission
  445 12th Street, SW
  Washington, D.C. 20554

  Attn: QUPID UWB Coordination

- If a Federal Government system is implemented or expanded subsequent to coordination and that system is within the coordination trigger, the operation of the QUPID system must cease unless its compatibility can be reestablished prior to the operation of the new or modified Federal Government system.

- The QUPID transmitters shall be supplied with the following information for the user:

  This transmitter has been certified under a waiver issued by the Federal Communications Commission. This equipment may not be operated until such time that the location and installation of the equipment has been coordinated with, and acknowledged by, the FCC. This coordination requirement is designed to ensure that the potential for harmful interference to other radio services is minimized.

- This waiver shall apply only to CWCEC's QUPID transmitter as well as to any subsequent models that have the same emission characteristics, *i.e.*, modulation, pulse repetition frequency, transmitter power, bandwidth, etc.

VI. ORDERING CLAUSES

23. Based on the above, we conclude that granting CWCEC's Request for Waiver will serve the public interest, convenience and necessity. Accordingly, pursuant to the authority delegated in Sections 0.31 and 0.241 of the Commission's rules, 47 C.F.R. §§ 0.31, 0.241, and Section 1.3 of the Commission's rules, 47 C.F.R. § 1.3, IT IS ORDERED that the Request for Waiver filed by CWCEC Controls IS GRANTED, consistent with the terms of this Order. This action is taken pursuant to Sections 4(i), 302, 303(e), and 303(r) of the Communications Act of 1934, as amended, 47 U.S.C. Sections 154(i), 302, 303(e), and 303(r).

24. For further information regarding this Order, contact John A. Reed, Office of Engineering and Technology, (202) 418-2455, john.reed@fcc.gov.

Julius P. Knapp
Chief, Office of Engineering and Technology